

**U.S. HOUSE OF REPRESENTATIVES  
COMMITTEE ON SCIENCE  
SUBCOMMITTEE ON RESEARCH**

**HEARING CHARTER**

*Implementation of the Math and Science Partnership Program: Views from the Field*

**Thursday, October 30, 2003**

**Noon - 2:00 p.m.**

**2325 Rayburn House Office Building**

**1. Purpose**

On Thursday, October 30, the Subcommittee on Research of the House Science Committee will hold a hearing to discuss the implementation of the Math Science Partnership (MSP) Program at the National Science Foundation (NSF). The MSP Program, part of President Bush's No Child Left Behind initiative, was authorized by the House in last year's NSF Authorization Act, which was signed into law in December. The program provides grants to partnerships of universities and school districts (and sometimes businesses) to improve K-12 math and science education. This hearing will be the Congress's first look at how this major new initiative is working.

**2. Witnesses**

- **Dr. Osman Yasar (Oz-mon Yash-ar), lead researcher for the Targeted MSP award at the State University of New York (SUNY) Brockport.** Dr. Yasar is a professor and chair of the computational science department at SUNY College at Brockport. He established the first undergraduate program in computational science in the United States and, prior to SUNY, he was a staff scientist at the Center for Computational Sciences at the Oak Ridge National Laboratory.
- **Mr. Ed Chi (Chee), Science Teacher at Brighton School District in New York.**
- **Mr. Jeff Mikols, Math Teacher, at Rochester City School District in New York.**
- **Dr. Susana Navarro (Nav-ARR-o), lead researcher for the Comprehensive MSP award at the University of Texas at El Paso (UTEP).**
- **Dr. Joan Ferrini-Mundy (Fer-RINI-Mun-dy), lead researcher for the comprehensive MSP grant at Michigan State University.**

**3. Overarching Questions**

The hearing will address the following overarching questions:

- How will awardees ensure that participants – mathematicians, scientists and engineers from higher education as well as K-12 teachers and administrators – are active in the

program, drawing on the expertise of all partners? What role, if any, will businesses or non-profit organizations play in the partnership?

- How will awardees provide meaningful, high quality training for pre-service and in-service teachers? How will this close the gap between the research findings on the way students learn and actual classroom practice? How will improvements in teacher content knowledge and pedagogy be assessed?
- How will reform efforts align with each state's challenging math and science standards and accountability measures? What sort of in-depth, quantitative evaluation will be conducted? And how will the results be disseminated?
- Are the awards a sufficient size to develop and test new education reform models? How will the partnerships coordinate with state educational agencies to foster and sustain the reform effort after the award period expires?

#### **4. Brief Overview**

- For decades, educators and policymakers have seen statistics that demonstrate a lackluster performance of U.S. students in math and science. Results from the National Assessment of Educational Progress show that a majority of U.S. students score below "proficient" in math and science, and the Third International Math and Science Study highlight our problems relative to other countries (see below).
- In response, Congress enacted two bills – the National Science Foundation Authorization Act of 2002 and the No Child Left Behind Act of 2001 – and created Math and Science Partnership Programs at the Department of Education and the National Science Foundation.
- These partnerships were to work together, with the National Science Foundation supporting model programs that create partnerships between the departments of math, science and engineering at colleges and universities with school districts to improve math and science proficiency for K-12 math and science teachers and students. The Department of Education was tasked with bringing the reform efforts to scale with grants to states and school districts.
- The annual authorization for the Department of Education partnership program is \$450 million for Fiscal Year (FY) 2002 and such sums for the next five fiscal years. The FY2002 appropriation was \$12.5, but the FY2003 appropriation grew to \$100.3 million. The authorization for the National Science Foundation partnership program is \$200 million for FY2003, \$300 million for FY2004, and \$400 million for FY2005. The FY2002 appropriation was \$150 million and the FY2003 appropriation was \$127.5 million. The President has requested \$12.5 million and \$200 million in FY2004 for the Department of Education and National Science Foundation partnership programs respectively.

#### **5. Background**

As part of the National Science Foundation Authorization Act of 2002 (P.L. 107-368), the Congress established the Math and Science Partnership Program in response to President

Bush's challenge to leave no child behind in education. Underlying this effort was data that showed that U.S. eighth and twelfth graders did not do well either by our own measurements or by international standards.

#### *Student Achievement in Math and Science*

The most recent results of the National Assessment of Educational Progress (NAEP) show that the trend for student achievement is generally up over the last 30 years, yet large numbers of U.S. students demonstrate a mastery of only rudimentary mathematics. In fact, 31 percent of 4<sup>th</sup> graders, 34 percent of 8<sup>th</sup> graders and 35 percent of 12<sup>th</sup> graders scored below "basic". Students in the basic category cannot demonstrate even partial mastery of the material that is appropriate for their age group, with, for instance, few 4<sup>th</sup> graders even knowing how many fourths make up a whole.

These low levels of achievement are more likely among minority groups and among children from low-income backgrounds. In the 2000 NAEP, 68 percent of African American 8<sup>th</sup> graders scored below basic in math compared to 23 percent of white students. And the achievement gap in NAEP math scores between white and black students and between white and Hispanic students has remained relatively unchanged since 1990.

On the Third International Mathematics and Science Study (TIMSS), an assessment that evaluates the math and science performance of 4<sup>th</sup>, 8<sup>th</sup> and 12<sup>th</sup> grade students from 42 different countries, U.S. performance relative to other nations declined with increased schooling. While U.S. children scored above average in elementary school, those in 12<sup>th</sup> grade – including our most advanced students -- ranked among the lowest of all participating countries, outperformed by nearly every industrialized nation and ahead of only Cyprus and South Africa.

These scores are disappointing and the reasons for them are complex. Yet one thing is certain – U.S. students are not getting a math and science education that will allow them to learn to their greatest ability. And their lessons neither engage nor challenge them. As a result, unacceptably low numbers of students are motivated to enroll in physics or chemistry and only 20 – 25 percent of graduating high school seniors have completed enough mathematics to be ready to study science or engineering. Because students who require remedial education are less likely to consider majors that require prerequisite classes in math, such as those in the physical, engineering and computer sciences, lack of preparation at the high school level clearly plays a role in many students' decisions to choose a major other than those in science, mathematics, engineering or technology. It is therefore no surprise that science and engineering degrees as a percentage of the population of 24 year olds have remained virtually constant at 5 – 6 percent. Within this group, women and minorities are seriously underrepresented.

#### *Legislation*

Raising student achievement is the focus of No Child Left Behind, an initiative by President Bush to fundamentally reform K-12 education. As part of this five-year effort, Math and Science Partnerships Programs seek to unite the activities of higher education, school systems and business in support of improved math and science proficiency for K-12 students and teachers. This is in large part a response to national concerns regarding too many teachers teaching out of field, too few students taking advanced coursework and too few schools offering challenging curricula.

Ultimately, two programs were created. The first established a competitive, merit-based grant program at the National Science Foundation (NSF), as part of the NSF Authorization Act of 2002 (P.L. 107-368). As enacted, this program would award grants to partnerships between institutions of higher education and one or more school districts to improve math and science education. Funds would be used to develop innovative reform programs that, if proven successful, would be the key to large-scale reform at the state level. The second was housed at the Department of Education and was created by the No Child Left Behind Act of 2001 (P.L. 107-110).

Although similarly titled, the programs were created to be complementary to – not duplicative of – each other. Specifically, NSF was to fund innovative programs to develop and test new models of education reform, thereby remedying a lack of knowledge about math and science research, while the Department of Education would broadly implement and disseminate new teaching materials, curricula and training programs. In so doing, the Education Secretary was required to consult and coordinate with the NSF Director.

#### *NSF's Math Science Partnership Program*

NSF's Math Science Partnership (MSP) Program competitively awards grants to institutions of higher education, or other eligible nonprofits, and their partners – one or more school districts -- to improve K-12 math and science education. In particular, the MSP Program must have the active participation of a math, science, or engineering department (as opposed to the education department) at the college or university, and the collaborations must be well-grounded in sound educational practices. Funds are required to be used for activities that improve K-12 math and science education, consistent with state standards, which may include:

- recruiting and preparing students for careers in K-12 math and science teaching,
- offering professional development for math and science teachers;
- offering pre-service and in-service programs to help math and science teachers use technology more effectively;
- developing distance learning for teachers and students;
- developing a cadre of master teachers;
- offering teacher preparation and certification programs for people who want to switch careers and begin teaching;
- developing tools to evaluate MSP activities;
- developing/adapting K-12 math and science curricular materials that incorporate contemporary research on the science of learning;
- developing initiatives to increase and sustain the number, quality and diversity of preK-12 teachers of math and science, particularly in underserved areas;
- using professionals to help recruit and train math and science teachers;
- developing or offering enrichment programs for students;
- providing research opportunities for students and teachers; and
- bringing scientists, engineers and other professionals to the classroom.

NSF supports two types of partnerships – Comprehensive and Targeted. Comprehensive projects are funded for a five-year period for up to \$7 million annually, depending on the scope of the project. These projects are intended to implement change in mathematics and/or science education practices in both institutions of higher education and in schools and school districts to result in improved student achievement across the K-12 continuum. Targeted projects focus on improved K-12 student achievement in a narrower grade range or a

disciplinary focus in mathematics and/or science and are funded for up to \$2.5 million a year for up to five years. In addition, the MSP Program funds Research, Evaluation and Technical Assistance (RETA) projects, which provide large-scale research and evaluation capacity and assist Comprehensive and Targeted awardees in the implementation and evaluation of their work.

The first competitions for MSP were held in FY2002, for which \$160 million was appropriated, and resulted in seven Comprehensive awards, 17 Targeted awards and 12 RETA awards. More recently, on October 2, NSF announced the award of \$216.3 million in funding for the second year of the MSP Program, with five Comprehensive awards, seven Targeted awards, and 10 RETA awards.

### *Education*

The MSP Program at the Department of Education, which is authorized by Title II, Part B of the No Child Left Behind Act, requires partnerships to include a state educational agency, the engineering, math, or science department of an institution of higher education and a high-need school district. Partners are required to use their grants for one or more specific activities. Among them are the following:

- professional development to improve math and science teachers' subject knowledge;
- activities to promote strong teaching skills;
- math and science summer workshops;
- recruitment of math, science or engineering majors to teaching through signing and performance incentives;
- stipends for alternative certification and scholarships for advanced course work;
- development or redesign of more rigorous standards aligned math and science curricula;
- distance learning programs for math and science teachers; and
- opportunities for math and science teachers to have contact with working mathematicians, scientists and engineers.

Unlike the NSF program, where funds are awarded competitively, the MSP Program at the Department of Education turns into a formula program to states when the amount appropriated exceeds \$100 million. In FY2002, \$12.5 million was appropriated for this program, but, in FY2003, the appropriations hit the trigger (\$100.3 million) and the funds were allocated to the states by the program's need-based formula.

**6. Award Abstracts on the MSPs run by Hearing Witnesses (verbatim, as provided to NSF)**

Promoting Rigorous Outcomes in Mathematics/Science Education (PROM/SE) – (Michigan State)

<b>Award Number</b>	0314866
<b>Start Date</b>	September 1, 2003
<b>Expires</b>	August 31, 2008 (Estimated)
<b>Expected Total Amount</b>	\$35,000,000.00 (Estimated)
<b>Investigator</b>	Joan Ferrini -- jferrini@msu.edu (Principal Investigator)
<b>Sponsor</b>	Michigan State University East Lansing , MI 48824
<b>NSF Program</b>	MSP- Comprehensive Awards

Promoting Rigorous Outcomes in Mathematics and Science Education (PROM/SE) is a five-year effort by a joint partnership between Michigan State University (MSU) and five consortia of school districts in Michigan and Ohio. The consortia includes three Intermediate School Districts in Michigan, Ingham, Calhoun, and St. Clair County, and two consortia in Ohio, the High AIMS Consortium and the SMART Consortium. The sixty-nine districts represent the broad range of social, economic, and cultural characteristics found in the United States as a whole being situated in large urban cities (Cleveland and Cincinnati) and their suburbs, in medium size cities with large minority populations such as Lansing, and in very rural areas such as those in St. Clair and Calhoun Counties.

The Partnership utilizes a unique combination of research and practice. Detailed data from all students and teachers using instruments from the Third International Mathematics and Science Study (TIMSS) is gathered. On the basis of these data Action

Teams of mathematicians, scientists, teacher educators and K-12 personnel collaborate to develop more focused and challenging content standards, align standards with instructional materials and improve mathematics and science teaching. Evidence-based and content focused professional development improves the subject matter knowledge of over 4,500 teachers of mathematics and science. Associates for mathematics and for science are fully prepared and engaged in the complex work of helping undertake substantial reform in all 715 schools. The mathematics and science opportunities for approximately 400,000 students improve and tracking disappears in all schools by 2006.

800 pre-service students participate and MSU reforms the preparation of future teachers through revision of pre-service education courses and programs. Partner sites mirror the diversity of the nation as a whole and the prototype is exportable and replicable on a larger scale.

## El Paso Math and Science Partnership

<b>Award Number</b>	0227124
<b>Start Date</b>	October 1, 2002
<b>Expires</b>	September 30, 2007 (Estimated)
<b>Expected Total Amount</b>	\$29,319,178 (Estimated)
<b>Investigator</b>	Susana Navarro -- navarro@utep.edu (Principal Investigator) (915) 747-5778
<b>Sponsor</b>	U of Texas El Paso University Ave at Hawthorne El Paso, TX 79968
<b>NSF Program</b>	MSP-Comprehensive Awards

The El Paso Math and Science Partnership (El Paso MSP) includes the three urban school districts that encompass El Paso, nine rural school districts in El Paso and Hudspeth counties, the University of Texas at El Paso (UTEP), El Paso Community College, the Region 19 Education Service Center, and El Paso area civic, business and community organizations and leaders.

The El Paso MSP is aimed at improving student achievement in mathematics and science among all students, at all preK-12 levels, and at reducing the achievement gap among groups of students. The goals of the partnership include:

- fully engaging university and community college leadership and mathematics, science, engineering and education faculty in working toward significantly improved K-12 math/science student achievement;
- ensuring the number, quality and diversity of K-12 teachers of mathematics and science across partner schools, particularly schools with the greatest needs;
- building the capacity of area districts and schools to provide the highest quality curriculum, instruction and assessment, and to ensure the highest level achievement in mathematics and science for every student;
- ensuring the K-16 alignment of mathematics and science curriculum, instruction and assessment, to ensure that students graduating from area high schools are prepared to enroll and be successful in mathematics, science and engineering courses at UTEP and El Paso Community College; and prioritizing research on educational reform and preK-16 partnerships.

**SUNY-Brockport College and Rochester City (SCOLLARCITY) Math and Science Partnership: Integrative Technology Tools for Preservice and Inservice Teacher Education**

<b>Award Number</b>	0226962
<b>Start Date</b>	January 1, 2003
<b>Expires</b>	December 31, 2007 (Estimated)
<b>Expected Total Amount</b>	\$3,385,448 (Estimated)
<b>Investigator</b>	Osman Yasar (Principal Investigator)
<b>Sponsor</b>	SUNY Brockport Brockport, NY 14420
<b>NSF Program</b>	MSP-Targeted Awards

**Abstract**

The project is proposed by a partnership between SUNY-Brockport, Rochester City School District (RCSD) third largest in New York state with the lowest achievement scores and Brighton Central School District (BCSD) with similar gaps among underrepresented groups yet with one of the highest overall achievement rates in the state. Additional partners are the Shodor Foundation and The Krell Institute. The primary goal for the partnership is to improve student outcomes in mathematics and science in grades 7-12 by creating a multi agency approach for the recruitment and professional development of mathematics and science teachers. A Computational Mathematics Science and Technology (CMST) approach to learning science is employed in which students and teacher are engaged in fieldwork, laboratory experiments, mathematical modeling, computer simulation and visualization.

CMST employs math models to describe physical phenomena therefore bringing a new perspective about the usefulness of math as a tool in real life. The method is designed to make science and mathematics concepts more easily comprehensible. A Challenge program incorporating CMST is providing tools and motivation for 200, grades 7-12 students, under the supervision of participating teachers. The approach in addition to teaching science concepts is designed to promote teamwork, collaboration and new strategies for problem solving. A component of the comprehensive professional development program for mathematics and science teachers is a four-week summer institute each year serving a total of 240 teachers. In addition there is a master's degree program for 30 teachers. Preservice education programs at SUNY Brockport are being revised and new courses are to be introduced to assure an improvement in the quality quantity and diversity of the new teacher workforce.



## 7. Questions for Witnesses

### Dr. Yasar

- How will you ensure that participants – mathematicians, scientists and engineers from higher education as well as K-12 teachers and administrators – remain active in the program? What role, if any, will the Shodor Foundation and the Krell Institute play in the partnership and in continuing the reforms after the award period expires?
- What type of professional development will your partnership provide? How will you accommodate the unique professional development needs of individual schools, especially since they vary widely in terms of student achievement? How will improvements in teacher content knowledge and pedagogy be assessed?
- Is your award a sufficient size to develop and test your education reform model and achieve your partnership goals?
- What sort of in-depth, quantitative evaluation will be conducted? And how will the results of this evaluation be disseminated?

### Dr. Ferrini-Mundy

- How will you ensure that participants – mathematicians, scientists and engineers from higher education as well as K-12 teachers and administrators – remain active in the program? How will you tailor your program to the unique needs of the sixty-nine participating school districts?
- What type of professional development will your partnership provide for pre-service and in-service teachers? How will you engage the nearly 4,500 teachers of math and science, all at different levels of ability and knowledge, in your reform efforts? How will improvements in teacher content knowledge and pedagogy be assessed?
- Is your award a sufficient size to develop and test your education reform models and achieve your partnership goals? How will the partnerships coordinate with state educational agencies to foster and sustain the reform effort after the award period expires?

### Dr. Navarro

- How will you ensure that participants – mathematicians, scientists and engineers from higher education as well as K-12 teachers and administrators – remain active in the program? What role, if any, will businesses and non-profit organizations play in the partnership?
- What type of professional development will your partnership provide for pre-service and in-service teachers? How will improvements in teacher content knowledge and pedagogy be assessed?
- Is your award a sufficient size to develop and test your education reform models and achieve your partnership goals? How will the partnerships coordinate with state educational agencies to foster and sustain the reform effort after the award period expires?

**Mr. Chi and Mr. Mikols**

- How has the SUNY-Brockport MSP Project helped teachers and administrators understand and embrace the need to teach to high quality, standards-based math and science? Based on what you know – and have experienced to date – are the participating schools getting closer to providing high quality math and science education for all students?
- How have the professional development opportunities provided by the MSP Project been different from other teacher training programs in terms of content, duration and intensity?
- What do you believe is the greatest barrier to bringing the latest and best research on math and science education into the classroom? Based on what you know, is teacher practice in the classroom changing?
- Based on your experience, how do we recruit and retain the best math and science teachers? How has the MSP Project addressed – or failed to address -- these issues?